XII.—*On some new Fossil Fish of the Carboniferous Period.*

By Frederick M'Coy, M.G.S. & N.H.S.D. &c.

[Continued from p. 10.]

Placoides.

(*Ichthyodorulites.*)

Homacanthus macrodus (M'Coy).

Sp. Char. Spine about 8 lines long and 2 lines wide at base, slightly arched and tapering to a point; section compressed, trigonal; anterior face formed by a narrow rounded keel, posterior concave face bounded on each side by a larger rounded ridge, between which and the anterior keel there is on each side a still smaller rounded longitudinal ridge, the two posterior ridges on each side dichotomise near their base; of the two intervening spaces the anterior is rather wider and the posterior rather narrower than the ridges which they separate, they are concave and very slightly striated longitudinally; posterior face with twelve or fourteen very large, compressed, falcate teeth, alternating in two rows, the alternating bases touching, keeled on their convex edge, their length nearly equalling the width of the side of the ray at their base.

The small size, few ridges and great posterior teeth easily distinguish this from other rays of the carboniferous period, while the two latter characters equally distinguish it from the *H. arcuatus* (Ag.) of the old red sandstone. This genus has not been noted before in the carboniferous series.

Rare in the carboniferous limestone of Armagh.

(*Col.* University of Cambridge.)

Homacanthus microdus (M'Coy).

Sp. Char. Spine about 1¼ inch long and 2 lines wide at base; very slightly arched, gradually tapering; section ovate; anterior face formed of a narrow rounded keel, each side with two slightly flattened nearly equal keels, the posterior one dichotomous at its base; they are their own width apart, the intervening spaces being flat and marked with about three longitudinal striæ; posterior face with two rows of numerous, conical hooked teeth, their length scarcely one-fifth the width of the ray at their base.

The more slender form, flattened ribs and interspaces, and numerous small conical teeth distinguish this from the last, with which alone it is likely to be confounded.

From the same locality and in the same collection as the last.

Ctenacanthus denticulatus (M'Coy).

Sp. Char. Spine nearly straight, slightly curved towards the apex; length of naked portion 5½ inches, length of the rapidly tapering base 2 inches, width near base 9 lines; section truncato-elliptical, sides slightly convex, front narrow, rounded; posterior face wide, depressed, concave at both sides, with an obtuse ridge in the middle, the lateral angles closely set with a row of numerous small, conical, downward-curved teeth on each, their own length apart; longitudinal ridges rounded, less than their own diameter apart (about four in two lines in the middle of the ray), they are a little wider at base than towards the apex, increasing in number downwards by dichotomy; the sides of each ridge are denticulated with sharp, recurved teeth extending halfway across the intervening spaces, the denticle of one side connected with its fellow on the other by a slightly oblique fold across the ridge, each pair being separated from that above and below by about the thickness of the ridge; near the posterior margin on each side are four or five ridges much smaller than the rest, crossed by oblique blunt tubercles.

This species slightly resembles the *C. crenatus* (Ag.) in its ornament, but instead of the short, close notches in the sides of the ridges of that species, this is distinguished by the more distant, tooth-like denticulation and narrow transverse plicæ.

Not uncommon in the dark shale (of the age of the yellow sandstone) of Monaduff, Drumlish, in the N. of Ireland.

(*Col.* University of Cambridge and Mr. Griffith.)

Ctenacanthus distans (M'Coy).

Sp. Char. Spine compressed, gently arched, very long, slender, tapering at the rate of only 3 lines in 5 inches; posterior face with two rows of numerous small, short, conical compressed teeth, slightly bent downwards, rather more than the width of their base apart; sides flattened with about ten or twelve close flattened longitudinal ridges of irregular width, the broadest occasionally subdividing as they approach the base, all the ridges crenulated by small tubercles, about double the thickness of the ridge from each other; those on the anterior ridges are transverse and slightly oblique, while those nearer the concave margin are smaller, and assume the appearance of lengthened, nodular swellings, as in *Physonemus*.

This is a remarkably long and slender ray; one specimen in the University collection at Cambridge, of which a considerable portion of the apex must be lost, measures six inches in length and only six lines in width at the broadest part near the base, the broken distal extremity being three lines wide, which would probably indicate a further inch and half of length. The portion of the base inserted in the flesh is small and gradually tapering. I am not certain of the exact form of the section.

Not uncommon in the red limestone of Armagh.

(*Col.* University of Cambridge and Capt. Jones, &c.)

Gyracanthus obliquus (M'Coy).

Sp. Char. Dorsal ray nearly straight, about one foot long and one and a quarter inch wide at base; section heart-shaped, width two-thirds of the antero-posterior diameter; anterior face narrow, rounded; posterior face broad, concave, having near the apex a row of small hooked teeth on each side; sides slightly convex, marked with numerous very oblique crenulated ridges or rows of tubercles, which meet the anterior face at an angle of about 35° (those of opposite sides meeting at an angle of 70°); the ridges become gradually more oblique, smooth, and entire near the apex, they are about half a line in width, and slightly more than their own diameter apart. The line of separation between the ridged external surface and the finely striated part which enters the flesh is very oblique and with a slight sigmoidal curve.

This large ray is most allied to the *G. tuberculatus* (Ag.), from which it is distinguished by the much greater obliquity of the sculptured ridges, and the more compressed form of the section; the *G. Alnvicensis* (Ag.) has ridges nearly as oblique as the present species, but they are smooth and entire instead of being strongly crenato-tuberculate.

Very common in the dark shale (at the base of the carboniferous system), supposed to be of the age of the yellow sandstone, in the valley of the Moyola, at Moyheeland, Draperstown, in the N. of Ireland.

(*Col.* Cambridge University and Mr. Griffith at Dublin.)

Physonemus arcuatus (M'Coy).

Sp. Char. Ray wide, much curved; longitudinal rounded ridges very numerous, about fifteen in the space of half an inch, less than their own diameter apart, dilated into rounded, smooth, bubble-like tubercles, which are nearly twice their diameter apart; the narrow sulci between the ridges have two or three obscure longitudinal striæ.

Distinguished from the *Physonemus subteres* (Ag.) by its much greater size, more numerous ridges and wide arcuate form.

Very rare: from the carboniferous limestone of Armagh.

(*Col.* Cambridge University.)

Asteroptychius semiornatus (M'Coy).

Sp. Char. Ray slightly arched, about 3 lines wide, and tapering at the rate of about 1 line in 1 inch; section much compressed, the sides being flattened, and the thickness about one-third the width; about eight narrow, longitudinal smooth ridges on each side, separated by flat spaces nearly twice the width of the ridges; all the spaces are marked with two or three obsolete longitudinal striæ, but only the anterior one on each side contains a row of irregularly placed tubercles.

This is more compressed and arched than the *A. ornatus* (Ag.), and differs besides in having but one row of tubercles on each side, while that species has a row in nearly every space.

Not uncommon in the Armagh limestone.

(*Col.* Cambridge University, &c.)

Erismacanthus (M'Coy), n. g.

(Etym. *ἔρεισμα, a prop or stay,* and *ἄκανθα, a spine.*)

Gen. Char. Spine of three divaricating portions,—1st, a large, compressed, finely striated base which entered the flesh; 2nd, a short, strongly compressed, rapidly tapering spine curved directly backwards, the sides marked with strong, smooth, longitudinal ridges, and having two rows of short downward-curved teeth on the posterior concave margin; 3rd, a peculiar prop-like portion extending directly forwards nearly at right angles with the base, gently arched downwards, compressed at the basal half, depressed at the distal half, closely covered with blunt, smooth, oval tubercles, and with some large, irregular spines on the under side; the portion of the base above the flesh and from which those two portions branch, is irregularly tuberculated.

The long anterior prop or stay-like branch renders this ichthyodorulite so unlike any described form, that I should have hesitated to describe it, but for the number of examples which I have recently examined. Something slightly analogous I observe in the articulation of the spines of the recent fish allied to *Synodontus,* in which a shorter but similarly curved and directed prop-like process may be observed, but which is concealed beneath the soft parts and not external as in the fossil. I know but one species of the genus, which I have great pleasure in dedicating to Capt. Jones, R.N., M.P. &c., who is in possession of more extensive and exact knowledge of the fossil fishes of the mountain limestone than I believe any other observer. It is to his acumen in recognising the true characters of the species, zeal in collecting, and liberality with which both his cabinet and information are made available to those studying the subject, that we are mainly indebted for the extended lists which have been published of the Ichthyolites of this formation.

Erismacanthus Jonesii (M'Coy).

Sp. Char. Posterior spine little more than twice as long as wide slightly curved, compressed, sides flattened, with about eight or nine longitudinal ridges, which are smooth and less than their own diameter apart; the intervening spaces finely striated longitudinally; posterior concave face with two regular, close rows of small pointed teeth directed very obliquely downwards; the surface towards the base is marked with small, scattered, oval, smooth tubercles; anterior branch three times as long, and about the same size at its origin as the posterior spine; the part of the spine from which those two portions take their common origin is equal to the width of their united bases, and covered with scattered round tubercles; the height of the anterior branch is double its width at the basal half, but it becomes depressed, so that its width is double the height in the section of the distal half; it is covered above and on the sides with close quincuncially arranged, smooth, oval tubercles; the compressed, finely striated base which enters the flesh seems abruptly truncated below. Length of posterior spine 1 inch, width at base 6 lines; length of anterior process (imperfect at extremity) 2 inches 9 lines, depth at base 4 lines, at tip 1 line; width at base 2 lines, at tip 3 lines; length of the common base 1½ inch, width 9 lines.

Not very uncommon in the carboniferous limestone of Armagh. (*Col.* University of Cambridge and Capt. Jones.)

Cosmacanthus carbonarius (M'Coy).

Sp. Char. Spine nearly straight, semicylindrical; section semilunate; sides and anterior face broadly rounded in one continuous curve; posterior sulcus very wide, rounded; about eight longitudinal rows of small oval tubercles on each side, the tubercles nearly touching in each row, and the rows less than their diameter apart; no posterior teeth, the posterior sulcus being bounded by the last lateral row of tubercles on each side. A fragment 1 inch 8 lines long and 2½ lines wide at the narrow end, increases at the rate of nearly 2 lines in an inch.

This differs from the Devonian *C. Malcolmsoni* (Ag.) in its greater size and much more numerous rows of tubercles. Two imperfect specimens from the limestone of Armagh are in the collection of Capt. Jones at Dublin.

Platycanthus (M'Coy), n. g.

Gen. Char. Ray triangular, very wide, the length of the base nearly equalling the height of the spine, arched backwards, much compressed; sides flat; anterior face flat, the thickest part of the ray; surface pustulated; two rows of sharp conical teeth on the posterior face.

In their great compression and pustulated surface the rays of this genus resemble the Oracanths, but they differ from them by their small size, arched form, and distinct posterior rows of teeth, which latter character also distinguishes them from the Byssacanths of the old red sandstone, as well as the absence of ridges on the surface. I only know the genus in the mountain limestone.

Platycanthus isosceles (M'Coy).

Sp. Char. Length of the base and height of the spine each about 1 inch; anterior face 1 line wide in the middle and slightly convex; surface covered with numerous smooth, oval or rounded tubercles subquincuncially arranged, largest towards the anterior face, about twice their diameter apart; intervening surface marked with minute, longitudinal rough sulci; posterior teeth conical, smooth at the apex, longitudinally plicated at the base.

Rare in the carboniferous limestone of Armagh.
(*Col.* Capt. Jones, R.N., M.P.)

Nemacanthus priscus (M'Coy).

Sp. Char. Ray much elongated, slightly arched, compressed towards the anterior face, which forms a prominent rounded ridge or keel; sides with numerous unequal, irregularly placed, oval, blunt tubercles, between which the surface is marked with longitudinal rows of minute impressed puncta, and a few irregular impressed flexuous striæ; base attenuated and finely striated.

This spine agrees with the Triassic Nemacanths in having the sides flattened and inclined towards the anterior face, on which is a central rounded ridge or keel. The only specimen I have seen is imperfect, measuring 3½ inches in length; the broken distal extremity is 4 lines in antero-posterior diameter and 2 lines wide.

From the red limestone of Armagh.
(*Col.* of Capt. Jones.)

Dipriacanthus (M'Coy), n. g.

(Etym. *δὶς*, *bis*, *πρίων*, *serra*, and *ἄκανθα*, *aculeus.*)

Gen. Char. Spine small, arched, tapering, much compressed, minutely and irregularly tuberculated; two rows of small conical teeth on the posterior margin, and two rows of larger adpressed teeth on the anterior face directed upwards.

The spines for which I propose this name are easily recognised by their small size, curved form, and having the anterior, as well as the posterior, margin armed with rows of teeth. These characters, while they separate them widely from the other fossil spines, strongly recall to our mind the *Pimelodes* and *Synodonts* of the Nile; in fact the *Synodontus serratus* described by Rüppell* is a perfect prototype, in its spinous defences, of our *Dipriacanthus falcatus,* except that both the anterior and posterior rows of teeth are single on the recent spines. In their compressed section and irregularly tuberculated surface the Dipriacanths resemble the Oracanths, but are distinguished by their arched figure and rows of teeth.

Dipriacanthus falcatus (M'Coy).

Sp. Char. Spine slender, gradually tapering, much hooked, compressed, sides convex; section oval, long diameter twice the length of the short diameter; surface with very minute irregular, longitudinal striæ, and few distant, irregularly scattered, small tubercles; teeth of the posterior margin short, conical, at right angles to the spine; teeth of the anterior margin slender, pointed, adpressed close to the spines with their points upwards. Length of specimen imperfect, at base 1 inch 2 lines, greatest width 2 lines.

The specimen described is from the carboniferous limestone of Armagh.

(*Col.* Capt. Jones, R.N.)

Dipriacanthus Stokesii (M'Coy).

Sp. Char. Slightly arched, much compressed, sides flat, anterior and posterior margins narrow, obtusely rounded; section oblong, the long diameter being from four to five times longer than the short; teeth of the posterior margin slender, conical, projecting at right angles to the spine; teeth of the anterior margin large, thick, smooth, the upper sharp edge widest, closely adpressed to the surface; surface closely covered with small, irregular, smooth granules, which under a strong lens are found to be radiatingly striated at their base, and with the intervening narrow spaces very minutely granulated.

When highly magnified the granulation of this spine resembles on a small scale the star-like style of ornament of the bony plates of *Asterolepis* (Eich.). The base is imperfect but apparently dilated in a remarkable degree, and in its present state the lower portion seems bent at a considerable angle from the curve of the rest of the spine.

---

* Beschreibung und Abbildung mehrere neuer Fische, im Nil entdeckt, Frankfort a. M. 1829, pl. 2. fig. 1.

Collected from the carboniferous limestone of Armagh by the Rev. W. Stokes of Caius College, Cambridge, and by him presented to the University collection. I have associated his name with this interesting form as a slight memorial of the zeal with which he has collected those remains, and the liberality with which he has made them available for public instruction.

Leptacanthus junceus (M'Coy).

Sp. Char. Nearly straight, about 1½ line wide; section semielliptical; sides nearly convex, meeting in front to form a sharp anterior edge, and converging behind to a narrow posterior sulcus, bordered on each side by a row of strong, conical, downward-curved teeth, little longer than wide, and about the width of their base apart; each side with about seven longitudinal, narrow, equal, thread-like ridges, twice their diameter apart, and having between each pair two or three obsolete longitudinal striæ.

Rare in the black beds at the the top of the carboniferous limestone of Derbyshire.

(*Col.* University of Cambridge.)

(CESTRACIONTES—*Teeth.*)

Psammodus canaliculatus (M'Coy).

Sp. Char. Tooth oblong, generally about twice as long as wide, the two long sides straight and parallel, one of the short sides or ends very convex, the other equally concave (for articulation); the crown of the tooth concave along the middle, the two long margins being prominent and rounded; there is generally a considerable hump-like elevation near the convex end; surface roughly wrinkled transversely, the ends generally more or less rudely plicated longitudinally.

This remarkable tooth is much allied to the *P. rugosus* (Ag.), but is strongly distinguished by its ends being formed for articulation, one convex and the other concave, instead of being straight as in that species; also by the strong longitudinal plication of the surface near the ends, and the peculiar, curved, swelling near the convex extremity. When the ends are wanting it is distinguished by its mesial concavity (the other being convex), and by the minute rugæ of the surface running across instead of in the direction of the length. When much worn the surface becomes polished and porous as in the *P. porosus* (Ag.), and as we constantly see on the prominent parts of the *P. rugosus* (Ag.). Length generally about 2 inches.

Rare in the Armagh limestone.

(*Col.* of the University of Cambridge and of Capt. Jones, M.P.)

Helodus appendiculatus (M'Coy).

Sp. Char. Transversely trigonal, compressed, width of the base rather more than twice the greatest height of the tooth; crown divided into an obtusely trigonal, straight, central compressed cone, and one very small, accessory similarly-shaped one on each side, sharply defined by a distinct notch; surface smooth, highly polished, porous at the apex and posterior side of the edge of the principal cone; edge of the enamel-like surface at the base obtuse, forming a slightly arched line, concavity downwards: bony root large, simple, coarsely fibrous.

Three teeth *in situ*, one behind the other, present the following characters:—the anterior tooth is the smallest, most compressed, and perfectly erect; principal cone sharp, but its height scarcely exceeding one-third of its width; secondary cone on each side very small, not as deeply separated from the middle as in the others; entire surface highly polished with the exception of the apex, which is slightly punctured. The second tooth is the longest and thickest, slightly inclined backwards; height of the principal cone about half its width; apex obtuse, small accessory cone on each side, pointed and defined by a deep notch from the central one; anterior side flattened, smooth, polished; posterior side tumid, coarsely punctured, the punctures extending over the apex. Third tooth entirely procumbent, the apex of the cone being marginal and in contact with the long, coarsely fibrous, osseous base, which latter is truncate below, is as wide as the tooth, and equals the principal cone in length: the proportions of this tooth are nearly those of the middle one, but having no posterior side; anterior side smooth and polished, apex punctured.

Rare: from the carboniferous limestone of Armagh.

(*Col.* Capt. Jones, R.N.)

Helodus rudis (M'Coy).

Sp. Char. Irregularly oblong, subquadrate; sides steep, irregularly nodulose or undulato-plicate; crown irregularly gibbous, the highest point a little nearer one end than the other; surface polished, coarsely punctured. Length 7 lines, width 4½ lines, height 2½ lines.

The curiously irregular lump-like figure and quadrate base of this species distinguish it easily from its congeners; the steep, striated margin is also peculiar. The puncturing of the surface rather coarser than that of the *H. turgidus* (Ag.). I have seen several specimens from the Armagh limestone.

(*Col.* Cambridge University.)

Chomatodus obliquus (M'Coy).

Sp. Char. Obliquely rhomboidal, transversely elongate; apex marginal, obtusely pointed; middle of the tooth obliquely tumid or convex; attenuated sides flattened or slightly concave; ends obtusely pointed or rounded; surface highly polished and perfectly smooth except at the apex, which is coarsely punctured; basal margin surrounded by a broad imbricating fold of ganoine*, increasing to three or four on the ends of some of the teeth.

This species differs from the *C. cinctus* (Ag.) in its obliquely rhomboidal flattened form and marginal apex, as well as having but one fold of ganoine at the middle of the basal margin. In some examples the ends are equal and the width three times the length, in others the ends are unequal, and the length two-thirds of the width, but in all the apex is marginal and the general form obliquely rhomboidal, the basal margin having a downward curve nearly opposite the apical projection of the anterior margin, and between the two extends the oblique mesial convexity. Length averaging 4 lines.

Rare, in the carboniferous limestone of Armagh.

(*Col.* Cambridge University and Capt. Jones, R.N. &c.)

Chomatodus denticulatus (M'Coy).

Sp. Char. Transversely oval, base about three times wider than long; middle elevated into a compressed, obtusely pointed cone, about equal in height to the short diameter (length) of base, from which a sharp, much compressed mesial ridge extends on each side to either end, its cutting edge being broken into numerous obtuse, compressed denticles decreasing in size towards the ends; the notches which separate the little cones on the edge give rise to obtuse sulci, defining them a short way down the sides; surface smooth; base surrounded with three or four imbricating folds of ganoine, irregularly jagged at their edges.

---

* I provisionally use this term (from γάνος, *splendour*) to designate that peculiar, dense, modification of *dentine* which forms the highly polished surface of most fish-teeth, and which is not unfrequently confounded with the true enamel of the teeth of the higher animals; the latter is however secreted by a distinct organ quite external to and independent of the dentine, while the false enamel which I propose to call *ganoine* is merely produced by the calcigerous tubes of the dentine becoming suddenly straighter, closer and more numerous as they approach the surface.

This species is rather smaller, more elevated and more compressed than the *C. cinctus* (Ag.), from which it is further distinguished by the number of minor cones set on the mesial ridge.

Rare, in the red carboniferous limestone of Armagh.

(*Col.* University of Cambridge.)

Petalodus rhombus (M'Coy).

Sp. Char. Crown sharp, compressed; *anterior face* rather more than *three times wider than high, regularly rhombic,* the upper and lower margins almost symmetrical, the lateral portions of each being nearly straight or slightly concave, and meeting in the middle at an obtuse angle; the angles of the upper and lower margins nearly equal, that of the basal margin pointing down, of the cutting edge up; the cutting edge is obscurely undulato-dentate by short obsolete vertical furrows, and minutely crenulato-striated; the lower margin is prominent and surrounded by five or six small imbrications of pseudo-enamel or ganoine, those descend lower (as usual) on the posterior face, where also the mesial angulation is less; surface smooth with a few fine irregular longitudinal striæ; root moderately large. Height of the middle of the crown 6 lines, width about 1 inch 9 lines, depth of root about 7 lines.

This can only be confounded with the *P. acuminatus* (Ag.), from which it is fully distinguished by the great proportional width of the crown and the rhomboidal form of the anterior face produced by the similar shape of the superior and basal margins; the latter being deeply angulated in the middle, resembling the cutting margin reversed in the present species, while the middle half is very obtusely rounded in the former, and then abruptly curved upwards and again downwards further towards the ends; in that species also the cutting edge, although slightly waving, is destitute of the broad longitudinal plicæ of the present form.

Rare, in the carboniferous limestone of Derbyshire.

(*Col.* Cambridge University.)

Polyrhizodus (M'Coy), n. g.

Gen. Char. Tooth thick, crown but slightly elevated, forming a transversely oval crushing surface, narrowing towards the extremities; anterior and posterior ridges separating the crown from the root, obtuse, without imbricating folds, the posterior ridge much lower than the anterior; root very large, deeply divided into several distinct, root-like lobes or fangs.

This is perhaps the most remarkable genus of ichthyolites yet made known, as it presents the only instance in the entire class of a fish-tooth divided into several distinct fangs—the imperfectly double, divaricating, base of certain sharks' teeth, or the prolonged external plicæ of certain sauroids (*Holoptychius, Rhizodus,* &c.) not deserving to be viewed in the light of really divided or fanged roots as in the mammals and the present genus of fish. The group is most allied to *Petalodus* (Owen), with which Agassiz seems to have unaccountably confounded one of the species; but instead of the thin, scale-like or petal-like character of the *Petalodi,* with their highly elevated, compressed, sharp-edged crown, we have here a tooth of remarkably thick and clumsy form, with the crown but little raised and all the parts obtuse; the crown in *Petalodus* is covered with a thick coat of smooth, highly polished enamel-like substance or ganoine, and separated on each side from the root by several imbricating folds, while the crown in the present genus is nearly as dull as the root, and in one species coarsely punctured as in *Psammodus,* and the characteristic basal imbrications are replaced by a simple, obtuse ridge; finally, in *Petalodus,* the root forms a large, simple, compressed truncated base, while in *Polyrhizodus* it is divided into from five to eight fangs.

Polyrhizodus magnus (M'Coy).

Syn. *Petalodus radicans* (Ag. MSS. name in collections).

Sp. Char. Tooth from one-half to two inches wide and about one inch in depth; crown from three to four lines wide, nearly flat, inclined at an angle of about 70° from the slightly raised posterior edge, smooth, or with minute branching striæ on the upper edge; anterior and upper margins nearly parallel for the middle half of the width, while they rapidly converge in the two outer fourths, so that the extremities are narrowed to a point at each end and considerably bent downwards; root very thick and deeply divided into six or eight long, ovate fang-like lobes, roughened by the passage of the nutrient vessels; inferior, posterior ridge is (like the anterior margin of the crown) simply rounded, without imbricating folds, and about one-third more than the width of the crown below the cutting edge.

This fine species is not uncommon in the limestone of Armagh. (*Col.* University of Cambridge, Capt. Jones, Mr. Griffith, &c.)

Polyrhizodus pusillus (M'Coy).

Sp. Char. Crown compressed, raised into a rounded obtuse lobe less than half the width of the base in height; base of the crown forming a very prominent obtusely rounded ridge; root divided into about ten small rounded fangs; surface of the crown coarsely punctured, a few of the punctures near the apex longitudinally confluent so as to give it a slightly pectinated appearance; width of crown 2½ lines.

Easily distinguished by its small size, coarsely punctured surface and the raised lobe of the margin of the crown.

Rare, in the limestone of Armagh, from whence there is one example in the University collection at Cambridge, and another in that of Capt. Jones.

Glossodus (M'Coy), n. g.

Gen. Char. Tooth tongue-shaped, oblong, quadrangular, much higher than wide; crown elevated, slightly recurved, narrowing from the base to a small, subtruncate apex; surface porous, puncta generally seeming confluent towards the apex; punctured surface terminating below in a notch, or arched line, the convexity upwards; root long, as wide as the crown, coarsely fibrous.

The *Glossodi* are distinguished from the *Helodi*, with which alone they have any affinity, by the quadrangular form of the horizontal section of the tooth, the sides being flattened as well as the anterior and posterior faces; also by the great height of the crown in proportion to its width. The long root-like base of the tooth, which resembles that of some *Petalodi* (e. g. *P. psittacinus*, Ag. MSS.), rather than that of *Helodus* in form, is of an open lacunose structure, being permeated by very large flexuous medullary canals producing irregular openings on the surface. The ridge separating the punctured surface from the base forms a sinus directed upwards, which is the reverse of what we find in *Petalodus*, approaching the ordinary sharks, and also conforming to what we see in *Helodus* and *Strophodus* when the separating line in those genera is not straight. As in *Petalodus*, the basal margin of the surface is much nearer the apex on the convex anterior side than on the concave posterior or internal face, the latter being generally about twice the length of the former. The characters above given as distinguishing those teeth from the *Helodi* also separate them from the genuine *Petalodi* of Owen, as also the want of the imbricating folds at the base.

Glossodus lingua-bovis (M'Coy).

Sp. Char. Height of the crown exceeding the width of the base, which is three times the width of the truncated apex; greatest antero-posterior diameter half the width of the base; surface dull, covered with coarse, wide, occasionally confluent puncta, the interstices crossed by minute, flexuous, oblique striæ.

This curious tooth resembles a neat's tongue in miniature;

the oblique striation crossing the ordinary punctuation of Psammodontoid teeth is a character I have not seen in any other tooth. Height of crown 6 lines, width of base 5 lines, depth of root 4 lines.

From the carboniferous limestone of Armagh.

(*Col.* Capt. Jones, R.N.)

Glossodus marginatus (M'Coy).

Sp. Char. Crown about one-third higher than wide, having a slight antero-posterior sigmoïdal curve; thickness, from before backwards, little more than one-fourth of the width; lateral margins subparallel, prominent on the posterior face, which is gently concave in the middle; apex narrowed, rounded, curved backwards; surface glossy, finely punctured, marked towards the tip with minute anastomosing longitudinal wrinkles; a few obtuse plicæ. Length of crown 5 lines, width 3 lines.

Easily distinguished from the *G. marginatus* by its more finely punctured, glossy surface, rounded tip and prominent lateral margins.

One of the rarest fossils of the carboniferous limestone of Armagh.

(*Col.* University of Cambridge; I think I have seen another in that of Capt. Jones at Dublin.)

Climaxodus (M'Coy), n. g.

(Etym. κλίμαξ, *a flight of steps,* and ὀδοὺς, *a tooth.*)

Gen. Char. Tooth longer than wide, gradually narrowing towards the front with nearly straight sides; anterior part of the crown crossed by broad, imbricating, transverse ridges at right angles to its length; surface minutely punctured.

The above generic name has reference to the remarkable step-like character of the ridges which cross the anterior part of the tooth at regular intervals. The broad posterior part of the tooth is without ridges and resembles a *Psammodus.* In the fact of being as it were small, ridged *Psammodi,* those teeth are allied to the genus *Pœcilodus,* but all the true *Pœcilodi* are inequilateral, mussel-shaped teeth, consequently placed in pairs in the mouth, and have the ridges oblique; the *Climaxodi,* on the contrary, are equilateral, and were therefore most probably mesial in position, and the ridging is transverse. I am aware of one species in the Armagh limestone and the following. I think it possible that the so-called *Pœcilodus parallelus* (Ag.) may ultimately be referred to this genus, as it differs from the true *Pœcilodi* in some at least of the above characters.

Climaxodus imbricatus (M'Coy).

The only specimen I have access to at present of this species is imperfect at each end, being 7 lines long, 5½ lines wide at the broad end, and 3 lines wide at the narrow anterior end; the anterior portion of the crown is crossed by 7 transverse imbricating ridges in a space of 4 lines, the posterior ones are three-fourths of a line apart, and have a double curvature arising from a small backward wave in the middle, the anterior ones are closer and pass with a slight forward curve across the tooth; all the imbrications have a backward curve at their extremities, giving them the appearance of lapping round the crown, and all have their free edges directed backwards, so as to resemble a row of *Petalodi* or other shark's teeth soldered together in the position they usually occupy, one behind the other; the posterior half is without ridges, the whole crown is slightly convex at the sides and concave in the middle; the surface is dull and seen by the lens to be finely punctured.

Rare, in the dark impure limestone overlying the main carboniferous limestone of Derbyshire.

(*Col.* University of Cambridge.)

Pœcilodus aliformis (M'Coy).

Sp. Char. Wing-shaped or contorto-subtrigonal, narrow before, broad and subtruncate behind; inner, straight margin thin, higher in the middle than at each end, the surface seeming concave from thence to the external oblique margin, which is abruptly deflected, much thickened, rounded, strongly arched downwards at each end, with a slight sigmoidal curve; this ridge is crossed by seven or eight large, obtusely rounded wrinkles, which become obsolete as they approach the thin inner margin; surface finely granuloso-punctate under the lens.

This species most resembles some of the wing-shaped forms of the *P. sublævis* (Ag.), but the whole tooth is more strongly contorted sigmoïdally; the external oblique margin is more thickened, ridge-like and deflected, and above all the great size of the transverse waves or wrinkles easily distinguishes it. The length of a perfect specimen is 1 inch 3 lines, width of the broad posterior end 9 lines, depth of the middle of the external margin 4 lines, width of the transverse wrinkles rather more than 1½ line.

Rare, from the black upper limestone of Derbyshire.

(*Col.* University of Cambridge.)

Pœcilodus foveolatus (M'Coy).

Sp. Char. Longitudinally clavate, depressed, nearly three times longer than wide; anterior end narrow subtruncate; surface obliquely crossed by nine or ten thick, flat, imbricating ridges, varying from one line to half a line wide; they run nearly straight, but each has got an abrupt angular bend about the middle, which makes the posterior half of each edge seem about half a line further out than the anterior half; each imbrication has one, or rarely two rows of large equidistant puncta or small pits.

This differs from the *P. Jonesii* (Ag.) in its very narrow elongate form, more numerous flat imbricating ridges, the row of notch-like curves one in the edge of each, and the regular rows of great puncta. The specimen described is imperfect, but seems to have been about 1¼ inch long and 4 lines wide.

From the upper black beds of limestone in Derbyshire.

(*Col.* University of Cambridge.)

Chirodus (M'Coy), n. g.

(Etym. *χεὶρ*, *manus*, and *ὀδοὺς*, *dens*.)

Gen. Char. General form of *Ceratodus*, that is more or less fan-shaped, thick, flattened, with the anterior broad margin deeply divided into lobes; but the inner, nearly straight margin has a small, recurved, thumb-like lobe projecting nearly at right angles from the middle of its length (preventing the mesial junction of the tritors of each side of the jaw); the inner marginal lobe is the longest; surface minutely punctured.

The only specimen which has occurred to me of this genus presents only two lobes in the anterior margin, but as the outer edge is imperfect there *may* have been another lobe, but I think not more. I should have referred the tooth to the Permian genus *Ceratodus*, but that the inner margin (which in *Ceratodus* is straight to fit the similar edge of the tooth on the other side of the jaw) has got a small lobe projecting horizontally inwards from its middle, which would prevent such a union; or if it be viewed as possibly the outer margin, we would have the equally singular characters not only of so great a disparity in size between two adjacent lobes, but the principal marginal lobes would *increase* in size from within outwards, which would be contrary to all analogy. Hence, independent of the geological importance of not extending unnecessarily the vertical range of a genus, we find it zoologically impossible to group together teeth so differently constructed that they could not be similarly arranged in the mouth. I have named the genus from the general resemblance to a hand, or still more to the foot of a *Chirotherium* in miniature.

Chirodus pes-ranæ (M'Coy).

Sp. Char. Length 8 lines, narrow; anterior lobes narrow, prominent, rounded, arched, separated by deep concave furrows; the inner lobe about a line longer than the next outer one; at the base of the former, or about half the length of the whole tooth, there projects horizontally inwards from the inner margin a short, wide, slightly recurved, flattened lobe, about 1 line long; posterior part of the tooth flattened; surface finely punctured under the lens.

This little species is something the size and shape of the foot of our common frog, whence the specific name.

Rare, in the black shaly beds of the carboniferous limestone of Derbyshire.

(*Col.* University of Cambridge.)

Orodus porosus (M'Coy).

Sp. Char. Subcylindrical, transverse diameter (or length of base) six or seven times greater than the antero-posterior; anterior and posterior margins nearly parallel, the middle being scarcely wider than the ends, which are obtusely subtruncate; sides slightly tumid, converging to a narrow mesial ridge; one small obtuse mesial cone not exceeding the short diameter of the base in height, and forming an obtuse ridge to the base on each; on each side there are four or five smaller tubercles, the smallest towards the ends, only those nearest the centre send one or two small ridges down the anterior side, while the posterior is more regularly ridged; basal margin tuberculato-plicate; surface coarsely punctured, except on the prominent worn points which are smooth; transverse diameter usually about 9 lines, short diameter $1\frac{1}{2}$ line.

In one example there are three nearly equal and similar teeth close behind each other; the mesial ridge is a little nearer the posterior than the anterior margin, and most so in the most anterior teeth.

From the carboniferous limestone of Armagh.

(*Col.* Capt. Jones, R.N., M.P.)

Orodus compressus (M'Coy).

Sp. Char. Much compressed, crown elevated into a thin edge of equal height throughout, surmounted by a fine ridge and festooned by four or five sharp points on each side; the centre has a larger point, producing a globular swelling in the middle of each of the flattened sides, over which it sends a small flexuous ridge giving out short branches on each side, while the lateral points only send short simple ridges not half-way down the sides; ends abruptly truncated; base surrounded by a sharply defined thickened border; surface smooth, highly polished; root nearly as deep as the crown is high, truncate below and at the ends; height of crown 1 line, width of base $3\frac{1}{2}$ lines.

This *Orodus* is extremely like a *Ctenoptychius* in general aspect, from the thin, compressed, rectilinear, nearly square form of crown and root, the prominent, defined ridge at the base of the former and its pectinated upper edge; this edge however instead of being sharp is surmounted by a little ridge, from which the small lateral ridges are given off as above-mentioned—characters which do not exist in *Ctenoptychius*.

Rare: from the same locality and in the same collection as the last.

Petrodus (M'Coy), n. g.

Gen. Char. Teeth conical, supported on a nearly circular osseous base, concave beneath; crown with a dense compact surface, height not exceeding the width, deeply furrowed with rough radiating ridges. *Microscopic structure*: vertical and horizontal sections nearly similar, showing the centre to be composed of exceedingly coarse irregular medullary fissures, irregularly branching and anastomosing as they approach the periphery, and sending out at right angles minute, flexuous, calcigerous tubes into the large, irregular clear interspace; the enamel-like surface forms a wide, dark-coloured band of fine, straight, parallel calcigerous tubes at the circumference of the magnified section.

The above generic name brings to mind not only the peculiarly rugged *crag-like* aspect of those teeth, but also their relation to the genera *Orodus* and *Acrodus* (Ag.), from both of which they are distinguished by a simply conic form, the base being nearly circular and not greatly lengthened in one direction as in those genera, as well as the dense stony character of the surface and great depth, coarseness and star-like disposition of the superficial vertical ridges. The base is slightly hollowed in the middle below, of a coarsely osseous texture, penetrated with numerous small vascular canals. It is interesting to observe that of all the fossil teeth yet made known, the microscopic structure of the *Petrodi* approaches nearest to the internal characters of the recent *Cestracion*.

Petrodus patelliformis (M'Coy).

Sp. Char. Conical, height one-half to two-thirds the width of the base, which is round or rarely subtrigonal; apex rudely pointed, becoming flat by wear; sides radiatingly ridged with about thirteen or fourteen very strong, single or dichotomous ridges, the sides of which are usually cut by numerous deep oblique sulci; the ridges are highest at the base, where they terminate abruptly; osseous base a little wider than the crown. Diameter of base 3 to 4 lines.

This tooth presents considerable variation in the proportion of height to width of the base, and also in the number and relative thickness and complexity of the ridges; there is no variety however sufficiently striking to require particular notice or occasion any difficulty in the identification of the species.

It seems abundant in some parts of the Derbyshire limestone.
(*Col.* Cambridge University.)

HYBODONTES.

Cladodus lævis (M'Coy).

Sp. Char. Principal cone very thick, slightly oblique, its height equal to half the width of the root; secondary cones two on each side, very strong, the outer largest and divaricating, nearly half the length of the principal cone; all the cones obtusely rounded at the summit, very slightly tapering, and the height of each slightly exceeding the width of its own base; base of the crown and osseous root concave; surface of all the cones smooth, highly polished. Width of crown 9 lines, height of principal cone from the basal margin 5 lines.

This closely resembles the *C. marginatus* (Ag.) in size and form, but the cones taper less and the species is fully distinguished by its smooth surface, destitute of the coarse longitudinal plaits or striæ of that or the allied species.

Carboniferous limestone of Armagh.
(*Col.* University of Cambridge.)

XIII.—Dr. MANTELL *on* Mr. SMITH's "*Observations*" *in Annals of Nat. Hist. for July* 1848.

To the Editors of the Annals of Natural History.

GENTLEMEN,

As I have neither leisure nor inclination to engage in controversy, I shall offer but one remark on the observations of Mr. Toulmin Smith.

In the last Number of the 'Annals' (p. 49) Mr. Smith has quoted certain passages from my 'Wonders of Geology' (6th edit. p. 638), which he is pleased to declare are at variance with opi-